Operating Instructions

F.M. DEVIATION METER

Type TF 934

MARCONI INSTRUMENTS LIMITED, ENGLAND

MARCONI
INSTRUMENTS

EB 934
3 - 3/61

OPERATING INSTRUCTIONS NO. EB 934

for

F.M. DEVIATION METER

TYPE TF 934

AMENDMENTS, if any, are included at the end of the handbook.

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DRAWINGS

FUNCTIONAL DIAGRAM ..... TBI 20390
COMPLETE CIRCUIT AND COMPONENT LISTS .. TD 22458

SCHEDULE OF PARTS SUPPLIED

The complete equipment comprises the following :-

1. One Instrument Type TF 934 complete with valves and lamp as under :-

Valves:	Eight:	Type EF 91 - CV 138
	Four:	Type EB 91 - CV 140
	Two:	Type QS95/10 - CV 286
	Two:	Type 6C4 - CV 133
	One:	Type 6X5G - CV 572
Lamp:	One:	6.5-V, 0.3-A, M.E.S.
Fuses:	Two:	3-amp, Cartridge Fuses.

2. One Mains Lead, Type 102 (ITB 134891).

3. One Input Cable with Terminating Unit, Type MI/P91281.

4. One Spare Lamp, 6.5-volt, 0.3-amp.

5. Two Spare Cartridge Fuses, 3-amp.

6. One Instruction Book No. EB 934.

1. DESCRIPTION

1.1 GENERAL

The Test Set is for the determination of carrier frequency deviation at audio frequency rates. The carrier frequency range extends from 2.5 Mc/s to 10 Mc/s and from 20 Mc/s to 100 Mc/s in a total of eight bands; the deviation ranges are 0 to 5 kc/s, 0 to 25 kc/s and 0 to 75 kc/s. In addition to the output operating the directly-calibrated deviation meter, an independently buffered outlet is provided for aural or visual monitoring.

The power pack is for 100 to 150 V and 200 to 250 V, 40 to 100 c/s.

1.2. DESIGN DETAILS

Basic Arrangement. The frequency-modulated carrier to be observed is heterodyned to an intermediate frequency and the resultant band of frequencies passed through a wide-band amplifier to a limiter and a differentiating circuit including rectifiers. Undirectional pulses of varying recurrence frequency emerging are then "counted" by an integrating system, the ultimate output being a wave of the original modulation frequency whose amplitude is strictly proportional to frequency deviation.

Measuring Circuit. The r.f. input is fed via a buffer amplifier to a frequency changer circuit comprising a local oscillator and diode mixer. The resultant beat frequency signal is passed to the i.f. amplifier and thence to a stabilized limiter.

The ensuing counting circuit comprises a parallel pair of opposed diodes fed via a small capacitor and constituting a system having a time constant small compared with the period of the input. Pulses of constant amplitude, but of varying recurrence frequency, charge the capacitor through the first diode, discharge taking place through the second diode and its load resistance, the mean current in the latter being directly proportional to the pulse rate - and hence to the frequency of the i.f. signal. Variation of frequency due to

frequency modulation produces an a.c. voltage superimposed on the d.c. component of the load voltage; the peak value of this voltage being directly proportional to peak frequency deviation, it is applied via an a.f. amplifier to a peak valve voltmeter calibrated in terms of deviation.

The deviation range switch selects the appropriate load resistance and either positive or negative deviation relative to the mean carrier may be determined by tuning the local oscillator above or below the signal frequency.

Checking Circuits. Features of the design are the inclusion of adequate setting up and checking facilities. To ensure that the local oscillator is set to produce the preferred intermediate frequency, the instrument is switched to TUNE, the d.c. component from the measuring diode then being applied directly to the indicating meter to produce a standard deflection. Similarly, to ensure that the input is adequate, the instrument is switched to CHECK INPUT; the meter then checks the level of the signal applied to the limiter.

Provision is made for checking and correcting the deviation indication. When the instrument is switched to SET DEVIATION, the circuit is interrupted after the first i.f. amplifier, the second i.f. amplifier then functioning as a crystal-controlled oscillator. At the same time, an alternating potential is impressed on the screen of the ensuing valve which suppresses the generated frequency at alternate half-cycles of the supply frequency; this produces a test signal of constant effective deviation against which the deviation scale may be standardized by adjustment of the SET DEVIATION preset control.

A.F. Output. For general convenience in operation, and also to enable the demodulated signal to be applied to a c.r.o. if desired, the output from the a.f. amplifier is passed through an auxiliary buffer stage and brought out both to a telephone jack and to a pair of terminals.

Power Pack. This is of conventional design, employing a full-wave rectifier circuit with choke-capacitance smoothing. The mains transformer permits the instrument to be operated from supplies of 100 V to 150 V or 200 V to 250 V, 40 to 100 c/s; the tap panel is accessible at the front panel.

2. OPERATION

2.1. INSTALLATION

Unless otherwise specified, the instrument is normally despatched with all valves, etc., in their holders and with the mains transformer adjusted for operation from a supply of 240 volts, 40 to 100 c/s. For other voltages between 200 V and 250 V, open the window on the front panel and adjust the tappings accordingly. For voltages between 100 V and 150 V, unscrew the tapping plugs, reverse the tapping plate and switch setting; then screw in the tapping plugs as required.

Connect the SUPPLY lead, switch ON the SUPPLY, note that the pilot lamp glows, and allow time for the valves to warm up and stabilize before setting up the instrument.

2.2. SETTING UP AND MEASURING DEVIATION

(1) Switch to SET DEVIATION and check that the meter deflects to the SET DEVIATION mark; if not, uncover the SET DEVIATION preset control and adjust accordingly. (When operating the TF 934 on a supply other than 50 c/s, to secure greatest accuracy, the setting of RV3 should first be readjusted as described in Section 3.3.).

(2) Switch to TUNE, connect the source under test to the Terminating Unit at the input end of the input cable and plug the connector into the appropriate INPUT socket. The minimum input required is about 55 mV at the LOW LEVEL socket and of the order of 700 mV at the HIGH LEVEL; use the latter when possible, to avoid overloading. The maximum input at the HIGH LEVEL inlet should not exceed 10 volts. Note: The Terminating Unit does not contain any attenuator or matching pad as it is simply a terminal block. The input impedance at either inlet is approximately 75 Ω.

Set the oscillator FREQUENCY RANGE selector and the tuning dial on its right to the frequency of the source, then slowly tune through the signal carrier, in the case of high frequencies using the incremental frequency control in the centre of the dial for fine adjustments. Note: The frequency calibration is correct when the indicator of the incremental knob is at the top.

It will be found that two maxima are indicated by the meter - one below and one above the carrier frequency; these are separated by a central point of zero response at which the carrier and oscillator are in tune and produce zero beat. Working from this central point, shift the frequency control slowly towards either of the adjacent maxima (above the signal frequency for positive deviation - that is deviation towards a higher frequency - or below for negative deviation) and continue until the meter reads at the TUNE mark. Critical tuning is necessary only when wide deviations are to be measured.

> WARNING: Do NOT continue to the peak and then come down on the other side of it to set to the standardizing mark. It is essential that the setting up should be done on the side adjacent to the zero beat point between the two maxima.

(3) Switch to CHECK INPUT and observe that the meter deflects to above the TUNE mark. If it is below the mark, increase the input accordingly, then recheck operation (2).

When the input is adequate - the working limits lie between about 50 mV and 1 volt for the LOW LEVEL input socket - varying the level of the incoming signal without varying its frequency should not change the meter indication when it has been set to TUNE as in (2).

(4) Switch to the required DEVIATION RANGE, read the meter and apply the appropriate range factors :- multiply by 3, multiply by 1 or divide by 5, as engraved on the panel.

> Note: By the use of suitable oscillator harmonics, a continuous range of 2.5 Mc/s to 200 Mc/s may be covered at normal input levels, and may be extended to 250 Mc/s where greater inputs are available.

Under normal working conditions the three ranges covering from 2.5 to 10 Mc/s employ the fundamental of the oscillator; the gap between 10 Mc/s and 20 Mc/s may, therefore, be filled by making use of the second harmonic of the oscillator when the fundamental is appropriately set in the 4 to 6.5 Mc/s or the 6.5 to 10 Mc/s range.

In the case of ranges between 20 Mc/s and 100 Mc/s, the oscillator is calibrated to function on its second harmonic; use, therefore, the fourth harmonic for frequencies up to 200 Mc/s and the fifth for frequencies up to 250 Mc/s.

2.3. USE OF A.F. OUTPUT TERMINALS AND PHONES JACK

These outlets are provided so that the modulation may be checked aurally or visually by connecting telephones, a c.r.o., a distortion factor meter or a wave analyser to the output of the a.f. amplifier. To avoid disturbing the circuit - and hence the accuracy of the deviation indication - both jack and terminals are fed via an independent buffer stage; the output impedance is of the order of 600 Ω and the level approximately 1 volt at f.s.d. on the meter.

3. MAINTENANCE

3.1. VALVES

These are listed on Page 2 under SCHEDULE OF PARTS SUPPLIED and may be replaced without materially affecting the operation of the instrument, although in certain instances it may be necessary to readjust the preset controls as described below. In any case, all diode and a.f. amplifier valves should be aged for at least 100 hours.

3.2. OPERATING VOLTAGES

The heater voltages should be within the limits 6.0 - 6.6 V a.c. The main h.t. voltage after smoothing should lie between the limits of 235 - 255 V d.c.

Using a high resistance voltmeter, the operating potentials at the valves should be of the following orders :-

Valve No.	Anode	Screen	Cathode
1	85 - 130	110 - 130	-
3	220 - 240	220 - 240	1.6 - 2.1
4	25 - 35	17 - 33	0.12 - 0.35
5	30 - 50	75 - 100	0.9 - 1.2
6	125 - 155	85 - 125	0.9 - 1.3
7	180 - 210	235 - 255	1.9 - 2.6
11	9 - 16	9 - 11	0.18 - 0.27
12	95 - 115	90 - 95	1.1 - 1.5
14	235 - 255	-	33 - 42
15	235 - 255	-	33 - 42

3.3. PRESET CONTROLS

The two preset controls RV2 and RV3 at the rear of the chassis deck are clamped by means of the locking-bar which spans them; normally they should not be disturbed as both have been carefully adjusted during final tests at the factory.

The preset potentiometer RV2 provides a variable central earthing point for the heater circuit of V11 and is not likely to require adjustment unless excessive supply frequency hum is present after fitting a replacement valve.

The variable preset resistor RV3 is used in the initial setting up of the frequency deviation calibration, in the following manner :-

(1) A signal of accurately known deviation - preferably determined by the 'disappearing carrier' method - is applied and preset RV1 (SET DEVIATION) adjusted to give the correct deviation indication on the meter.

(2) With the Switch at SET DEVIATION, preset RV3 is adjusted to bring the meter to the SET DEVIATION mark. Preset RV3 is then locked.

CONI INSTRUMENTS LTD.					TITLE	FUNCTIONAL DIAGRAM F.M. DEVIATION METER		
J.F.G. 2.7.50	CHKD.	RR	APPD.		STOCK LIST	TF. 934	DRG. No.	TBI.20390

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